

TITLE OF THE INVENTION

DATA COMMUNICATION TERMINAL

CROSS-REFERENCE TO RELATED APPLICATIONS

5 This application is based upon and claims the  
benefit of priority from the prior Japanese Patent  
Application No. 2000-339491, filed November 7, 2000,  
the entire contents of which are incorporated herein by  
reference.

BACKGROUND OF THE INVENTION

10 1. Field of the Invention

The present invention relates to a data communica-  
tion terminal for conducting data communications by use  
of a communication network where at least accounting  
is carried by data amount, and a method thereof, and  
15 a computer readable recording medium that stores  
a program including commands that makes a computer  
execute actions of such a data communication terminal.

2. Description of the Related Art

In the prior art, in the accounting methods of  
20 communication charges in data communications, there  
have been an accounting method according to connection  
time, and an accounting method according to the  
transmitted/received data amount, and communication  
charges by these respective methods are accumulated,  
25 and charges are demanded to users periodically, for  
example, an monthly basis or the like.

In order to avoid such a case where a monthly bill

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for such higher charges as users do not forecast should not be made, connection time or the transmitted/received data amount is calculated at a terminal device of each user, and the accumulative charges are  
5 calculated according to the accounting method, and the charges at the moment are displayed at necessity so that each user can see his charges at sight.

A technique that gives a warning to a user in the case when the charge limit set by the user is exceeded  
10 is well known. Thereby, a user who has been given such a warning may keep from using connections, and accordingly unexpectedly high charges may be avoided.

In the case of the accounting method according to the transmitted/received data amount, when the amount  
15 of data to be transmitted/received continuously is small as in text data, the charges appear smaller than in the case of the accounting method according to connection time, hence convenient, while when the amount of data to be transmitted/received continuously  
20 is large as in downloading image data, charges will become higher. Especially, in the case of using an extremely high speed communication line, users may transmit/receive a large amount of data without noticing, as a result, communication charges will  
25 become enormous in a short time. If the transmitted/received data is really necessary for a user, then it is all right, on the other hand, if data is unnecessary

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or valueless, then a user feels it very wasteful, and the cost performance of communications as a whole will be deteriorated, which has been a problem seen with the prior art.

5           In other words, in the prior art mentioned above, users keep from using further connections when the preset limit amounts are exceeded, so that unexpectedly high charges may be prevented from being issued to users. However, the prior art has failed to improve  
10       communication cost performance by reducing receiving and sending of unnecessary data, which has been the problem with the prior art.

#### BRIEF SUMMARY OF THE INVENTION

          Accordingly, in the present invention, when  
15       carrying out data communication by connecting a data communication terminal to a communication network where accounting is made according to a data amount, the start and end of transmission/reception of a set of objective data are recognized, and the amount of data  
20       transmitted/received from the start to the end of transmission/reception of the set of objective data to be recognized is measured, and it is judged whether or not the measured transmitted/received data reaches a specified data amount, and when it is judged that  
25       the transmitted/received data amount has reached the specified data amount, a warning to that effect is given to users.

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When carrying out data communication by use of  
a communication network among a communication network  
where accounting is made according to the data amount  
and a communication network where accounting is made  
5 according to connection time, the communication charges  
required for data communication are calculated in real  
time manners according to the selected communication  
network, and it is judged whether or not the calculated  
communication charges reaches the preset limit amount  
10 of communication charges, and when it is judged that  
the calculated communication charge has reached the  
preset limit amount, an warning to that effect is given  
to users.

Additional objects and advantages of the invention  
15 will be set forth in the description which follows, and  
in part will be obvious from the description, or may  
be learned by practice of the invention. The objects  
and advantages of the invention may be realized and  
obtained by means of the instrumentalities and  
20 combinations particularly pointed out hereinafter.

#### BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWING

The accompanying drawings, which are incorporated  
in and constitute a part of the specification,  
illustrate embodiments of the invention, and together  
25 with the general description given above and the  
detailed description of the embodiments given below,  
serve to explain the principles of the invention.

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FIG. 1A is a block diagram showing a constitution of a data communication terminal according to a first embodiment of the present invention.

FIG. 1B is a diagram showing a parameter memory constitution of a RAM in a data communication terminal.

FIG. 2A is a diagram showing an entire system constitution using a data communication terminal according to the first embodiment of the present invention.

FIG. 2B is a flowchart of communication connection request processing in a data communication terminal.

FIG. 3A is a diagram showing a display and setting screen of an account warning.

FIG. 3B is a flowchart for explaining details of warning display and instruction waiting processing in FIG. 5.

FIG. 4 is a flowchart for explaining account warning setting actions in a data communication terminal.

FIG. 5 is a flowchart for explaining details of communication processing in FIG. 2B.

FIG. 6A is a diagram showing a parameter memory constitution of a RAM in a data communication terminal according to a second embodiment of the present invention.

FIG. 6B is a diagram showing an available communication network control table.

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FIG. 7A is a diagram showing the former half of a series of flowchart for explaining a communication connection request processing.

5 FIG. 7B is a diagram showing the latter half of a series of flowchart for explaining a communication connection request processing.

10 FIG. 8A is a diagram showing a parameter memory constitution of a RAM in a data communication terminal according to a third embodiment of the present invention.

FIG. 8B is a flowchart for explaining details of communication processing in the third embodiment of the present invention.

#### DETAILED DESCRIPTION OF THE INVENTION

15 Embodiments of the present invention will be explained with reference to FIG. 1A through FIG. 8B.  
[First Embodiment]

20 FIG. 2A is a diagram showing an entire system constitution using a data communication terminal according to a first embodiment of the present invention.

25 That is, a data communication terminal 10 according to the first embodiment of the present invention is constituted so as to be connected to a LAN 12 in a certain enterprise where a server is arranged for transmission/reception of data via a packet communication network 11 as a communication

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infrastructure.

Herein, the data communication terminal 10 is a terminal that has a built-in communication module as mentioned later and thereby enables wireless communications. The packet communication network 11 is provided with a base station 13 for conducting communications with the data communication terminal 10, a circuit switching control equipment 14, and a router 15.

While, the LAN 12 in a certain enterprise is provided with a router 16 and a server 17. The router 15 of the packet communication network 11 and the router 16 of the LAN 12 in a certain enterprise are connected with each other via a leased line 18.

By the way, the packet communication network 11 need not to be a wireless communication infrastructure, but may be one employing an analog public line and the like.

FIG. 1A is a block diagram showing a constitution of the data communication terminal 10 according to the first embodiment of the present invention.

That is, this data communication terminal 10 comprises a CPU 20, a ROM 21, a RAM 22, a liquid crystal display device 23, an LCD driver circuit 24, a key matrix 25, a key I/F circuit 26, a communication module 27, and a power source circuit 28.

Herein, the CPU 20 is for carrying out various controls of respective portions in the data

communication terminal 10. The ROM 21 is a read only  
memory for storing a program and the like, and the RAM  
22 is a temporary memory for work. The liquid crystal  
display device 23 is an output device necessary for  
5 interface with human beings, while the LCD driver 24  
is for driving the liquid crystal display device 23.  
The key matrix 25 is a touch key matrix arranged on the  
display screen of the liquid crystal display device 23,  
and the key I/F circuit 26 is for tap position detec-  
10 tion in the key matrix 25. The communication module 27  
is for carrying out data communications by the packet  
communication network 11. The power source circuit 28  
supplies main power source necessary for respective  
portions, and also provides backup power source to the  
15 RAM 22 so as to keep various parameters of warning  
display to be mentioned later into the RAM 22.

As shown in FIG. 1B, in the RAM 22, areas to store  
charge information per packet 22A, a warning display  
flag 22B, a displayed flag 22C, specified warning money  
20 amount information 22D, current charge 22E, previous  
charge 22F, start date information 22G, end date  
information 22H, a transmitted packet counter 22I, and  
a received packet counter 22J, as various parameters of  
the kept warning display, are arranged.

25 These various parameters are set in a charge  
warning display and setting screen as shown in FIG. 3A.  
By the way, this charge warning display and setting



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per packet set in the up and down cursors 30, this set warning money amount is displayed as a value calculated by the data amount. In this example shown herein, the warning money amount is 9999 yen, and the data amount corresponding thereto is 124,987.5 KB. This warning money amount (and/or the corresponding data amount) is stored into the specified warning money amount information 22D of the RAM 22.

The column "current charge" is an accumulative display of the communication charge from the previous resetting to the current time. This cannot be set by a user. The accumulative money amount to be calculated according to the amount of data to be transmitted/received during data communications to be described later is stored to the current charge 22E of the RAM 22, and is also displayed in this column. This as well as the column "specified warning money amount" also displays data amount corresponding to the money amount. In the case of this example, the money amount is 4,300 yen and the data amount is 53,750.0 KB.

The column "reset" 34 is for instructing to convert the current data communication accumulative charge and accumulative data amount into the previous data communication accumulative charge and accumulative data amount. That is, tapping this "rest" 34 clears the current data communication accumulative charge and accumulative data amount. At this moment, the previous

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charge period is rewritten as below. That is, the previous end date is rewritten into the start date, and today is rewritten into the period end day. These start date and period end date are stored to the start date information 22G and the end date information 22H of the RAM 22, in yy/mm/dd format.

The column "previous charge" is to display the accumulative communication charge from the reset before the last to the previous reset in unit of 1 yen (and the accumulative communication charge is stored into the previous charge 22F of the RAM 22). This column as well as the "specified warning money amount" also displays an accumulative data amount 35 corresponding to the money amount. In this example, the money amount is 999,999 yen and the data amount is 12,499,998.0 KB. A period 36 until the reset was pressed previously is also displayed.

By the way, at the completion of the display and setting of the account warning, tapping an "OK" 38 at the right top exits this display. In this charge warning display and setting screen, a soft keyboard display 37 is arranged at the bottom for the case of alphanumeric entry.

Other parameters are as shown below. Namely, the displayed flag 22C is a flag for showing whether or not warning display has been already made. The transmitted packet counter 22I is a counter for counting the number

of packets of transmitted data, while, the received packet counter 22J is a counter for counting the number of packets of received data.

5 In the next place, actions in the constitution mentioned above will be explained.

FIG. 4 is a flowchart for explaining account warning setting actions in the data communication terminal 10 according to the first embodiment of the present invention. A program that realizes the  
10 respective functions listed in this flowchart is stored in the ROM 21 in the format of program codes that a CPU 20 can read. Of course, this program may be read from storage media such as a floppy disk, an optical (magnetic) disk and the like, or may be received by the  
15 communication module 27 from an external device, and stored into the RAM 22.

That is, when a user opens the charge warning display and setting screen, the actions shown in this flowchart are started, and first, it is judged whether  
20 or not there is a screen tap input by the user (step S11). If there is not a screen tap input, the process jumps to a step S25 to be described later.

On the contrary, if there is a screen tap input, the place of the tapping is judged (step S12).

25 Herein, when the up cursor on the charge per packet is the place of tapping, the charge information per packet 22A is increased by 0.01 yen (step S13),

while, when the down cursor on the charge per packet is the place of tapping, the charge information per packet 22A is decreased by 0.01 yen (step S14).

On the other hand, when the charge warning check box 31 during communications is judged as the place of tapping, the warning display flag 22B is inverted (step S15).

Or, when the specified warning money amount up cursor is judged as the place of tapping, the specified warning money amount information 22D is increased by 1 yen (step S16), while, when the specified warning money amount down cursor is judged as the place of tapping, the specified warning money amount information 22D is decreased by 1 yen (step S17).

When the "reset" 34 is judged as the place of tapping, a specified reset confirmation display (not illustrated) is carried out (step S18), and user confirmation is carried out (step S19). If this user confirmation is "NO", the process jumps to a step 24 to be described later. On the contrary, if the user confirmation is "YES", the previous period end date (end date information 22H) is copied to the period start date (start date information 22G) (step S20), and the date of today is written into the period end date (end date information 22H) (step S21). The current charge 22E is rewritten into the previous charge 22F (step S22), and the current charge 22E is cleared

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(step S23).

After the processing by the respective places of tapping mentioned above, a display rewriting process is carried out (step S24), and thereby making display in accordance with updated parameters. Thereafter, whether or not to end this charge setting action, i.e., whether or not the "OK" 38 is tapped is judged (step S25), and when the judgment is "NO", then the process goes back to the step S11. While, if the judgment is "YES", then this charge warning setting actions are completed.

FIG. 2B is a flowchart of communication connection request processing in the data communication terminal 10.

That is, at a communication connection request from a user, the actions shown in this flowchart get started, and first, communication connection to the packet communication network 11 by the communication module 27 is started (step S31). By communication processing whose details are described later, data is actually transmitted/received (step S32). Thereafter, the current charge is added to the current charge 22E and stored (step S33), and communication connection to the packet communication network 11 is completed (step S34), and this communication connection request processing is finished.

FIG. 5 is a flowchart for explaining details of

communication processing at the step S32.

That is, first of all, initial processing is carried out (step S32A), and thereby clearing the transmitted packet counter 22I and the received packet  
5 counter 22J, and clearing the displayed flag 22C.

In the next place, it is judged whether or not there is transmitted/received data (step S32B), and when there is not, the process jumps to communication completion judgment of a step S32K to be described  
10 later.

On the contrary, when there is transmitted/received data, transmitted/received data processing by the communication module 27 is carried out (step S32C). The number of packets transmitted this time is added to  
15 the transmitted packet counter 22I (step S32D). In the same manner, the number of packets received this time is added to the received packet counter 22J (step S32E). The value of this transmitted packet counter 22I and the value of the received packet counter 22J  
20 are added, and the total value is multiplied by the money amount per packet displayed by the charge information per packet 22A, and thereby the current communication charge is calculated (step S32F).

Thereafter, it is judged whether or not the  
25 displayed flag 22C is "0" and the warning display flag 22B is "1" (step S32G), and if it is not so, i.e., if warning display has been already made, or if a user

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has not set to display warning, the process jumps to communication completion judgment of a step S32K to be described later.

On the other hand, if the displayed flag 22C is "0" and the warning display flag 22B is "1", i.e., if warning display has not been made yet and a user has set to display warning, it is judged whether or not the current communication charge exceeds the specified warning money amount (step S32H). If it does not exceed, then the process jumps to communication completion judgment of a step S32K to be described later.

On the contrary, if the current communication charge exceeds the specified warning money amount, warning display and instruction waiting process whose details are described later is carried out (step S32I), and the displayed flag 22C is set to "1" (step S32J). Thereafter, it is judged whether or not communication is finished (step S32K), and in the case of "NO", the process goes back to the step S32B. In the case of communication completion, this communication process is finished, and the process returns to the upper routine.

FIG. 3B is a flowchart showing the details of warning display and instruction waiting process of the step S32I.

That is, a warning that the communication charge has exceeded the specified warning money amount is



made, and at the same time, transmission/reception data is suspended temporarily, a warning display processing is made wherein a message asking a user whether or not to continue communication process is displayed (step S32I1). Together with this warning display, a warning sound such as a buzzer sound or the like may be generated. According to the message, it is judged whether or not the user has selected to continue the communication processing (step S32I2). Herein, when the communication processing is selected to be continued, the process returns to the upper routine, and then goes to the step S32J. On the contrary, when the user has selected not to continue the communication processing, the process jumps to the return destination of the upper routine, that is, the step S33 of the main routine.

In the first embodiment, when a user of a data communication terminal sets the specified warning money amount, a money amount at which the user thinks it is necessary to pay attention in, for example, one time of communication connection is set. Every time when the data communication terminal is connected to a packet communication network, the amount of transmitted/received data from the start to the end of communication connection is counted, and when the communication charge exceeds the set money amount, a warning is made to the user, and at the same time,

transmission/reception of data is suspended temporarily. According to instructions from the user, the transmission/reception process is resumed or terminated. Thereby, the user can grasp and control his communication charge per month, and optimize the distribution of daily communication time toward the payment of communication charge at the end of every month.

[Second Embodiment]

In the next place, explained is a second embodiment of the present invention hereinafter.

In the second embodiment, in addition to the accounting method according to the transmitted/received data amount as in the first embodiment, the accounting method according to connection time may be selected, and further, communication charge is counted not at every time of communication connection but per specified data.

Therefore, in this second embodiment, so as to cope with the accounting method according to connection time, in the RAM 22, an area for storing the parameter of a unit time charge 22M, as shown in FIG. 6A, is arranged in addition to the parameters in the first embodiment.

An available communication network control table 22a is also stored as shown in FIG. 6B. This is a table that stores available communication networks

and accounting methods to respective connection destinations.

In this second embodiment, communication connection request processing is as shown in a series of flows illustrated in FIG. 7A and FIG. 7B.

That is, at a communication connection request from a user, the actions shown in this flowchart are started, and first, input of a connection destination by a user is accepted (step S41).

Thereafter, an available communication network for access to the connection destination is selected from the available communication network control table 22a, and communication connection is started by the communication module 27 (step S42).

Then, the process waits for input (step S43), and when there is input, the input information concerned is analyzed (step S44). As the result of the analysis, and it is judged whether or not an operation that requires transmission/reception data of, for example, Web page data reading instruction and the like has been made (step S45), and if not, then further, it is judged whether or not a communication connection completion instruction has been made (step S46). When the communication connection completion instruction has not been made, various data processings are carried out on the basis of the input information (step S47), and the process returns to the step S43. When it is

judged that the communication connection completion instruction has been made, communication connection to a communication network is completed (step S48), and this communication connection request processing is finished.

On the other hand, in the step S45, when it is judged that an operation requiring transmission/reception data has been made, a set of objective data to be transmitted/received is recognized on the basis of the input information (step S49). For example, when reading Web page data is instructed, it is recognized in which URL web page data should be read. By the available communication network control table 22a, it is judged whether or not the accounting method in the current connection destination and communication network is data amount accounting method (step S50). Herein, if it is the case of data amount accounting method, the same communication processing as in the aforementioned first embodiment is carried out (step S51), for example, in the example of the Web page data, one screen data of Web page data at the specified URL is read as a set of objective data to be transmitted/received. Thereafter, it is checked whether or not there is tag information showing sub data in the set of objective data received in this step S51 (step S58), and when there is tag information showing sub data, then another set of objective data

to be transmitted/received is recognized once again according to the tag information (step S59). For example, in the example of the Web page data, if there is tag information showing image data in the Web page data, it is recognized in which file the image data to be downloaded is stored on the basis of the tag information.

Thereafter, the process goes back to the step S50, and the specified accounting method is judged once again, and the set of sub data is transmitted/received according to the communication processing corresponding to the accounting method. In the example of the Web page data, the recognized image data file is transmitted/received. At this moment, so as for a user to know that the image data file is now being transmitted/received, a specified icon is displayed at the position where the tag information in the Web page display screen is set. Sending and receiving the set of sub data continues until any tag information showing other sub data disappears in the Web page data. If there is not tag information showing sub data in the step S58, the process goes back to the step S43, and input waiting status gets in once again.

In the step S50, if the accounting method is judged as not the data amount accounting method but the connection time accounting method, part of data to be transmitted/received is transmitted/received

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(step S52). Thereafter, on the basis of the communication connection time and the unit time charge stored in the unit time charge 22M, communication charge is calculated (step S53). It is judged whether or not the calculated communication charge exceeds a second specified warning money amount corresponding to the connection time accounting method stored in the specified warning money amount information 22D (step S54), and if it does not exceed, further it is judged whether or not there is data left (step S55). Herein, if there is data left, the process goes on to the step S52, while if there is not data left, the process goes on to the step S58.

In the step S54, if it is judged that the calculated communication charge has exceeded the specified warning money amount, after a warning is displayed (step S56), transmission/reception data is suspended without waiting for instruction from a user (step S57). The process goes on to the step S48, and communication connection to the communication network is finished, and this communication connection request processing is completed. By the way, the warning display in the second embodiment is made by a message to notify communication charge from the start of transmission/reception specified data, in the place of a message to notify communication charge from the start of connection as shown in FIG. 3B.

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In the second embodiment, a set of objective data to be transmitted/received is recognized on the basis of input instruction from a user, or tag information showing sub data included in data, and the amount of data transmitted/received is counted per the data to be transmitted/received and to be recognized. When the communication charge exceeds a preset warning money amount, a warning is given to the user, and at the same time, transmission/reception data is suspended temporarily, and waiting status gets in. According to instructions from the user, the transmission/reception process is resumed or terminated. Thereby, the user can grasp and control his communication charge every individual transmission/reception objective data. Even when communication speed is very high, the user can judge the importance degree of the data now being transmitted/received, and instruct whether or not to continue transmission/reception, before transmission/reception a great amount of unnecessary data, thereby user can prevent wasteful communication charge, and carry out effective data communications.

[Third Embodiment]

A third embodiment of the present invention will be explained hereinafter.

In the third embodiment, as shown in FIG. 8A, areas for storing parameters of current warning money amount information 22K and warning money amount

The communication processing carried out in the step S51 in the second embodiment is made as shown in FIG. 8B.

5           That is, first the transmitted/received packet  
counters 22I and 22J are initialized (step S32a), and  
further, the current warning money amount information  
22K is initialized by the specified warning money  
amount stored in the specified warning money amount  
10 information 22D (step S32b).

The transmission/reception object data recognized in the step S49 or the step S59 in the second embodiment is transmitted/received by one packet (step S32c), and the transmitted/received packet counters 22I and 22J are updated accordingly (step S32d). Thereafter, the values of the transmitted/received packet counters 22I and 22J are multiplied by the charge per packet stored in the charge information per packet 22A, and thereby communication charge required for the data to be transmitted/received until the present is calculated (step S32e). It is judged whether or not the calculated communication charge has exceeded the current warning money amount stored in the current warning money information 22K (step S32f). Herein, if it has not exceeded, the process jumps to a step S32k to be described later.

On the contrary, if the communication charge has



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plural packets is investigated, and thereby when packet data having identical identification information continues, then it is judged that there is still a packet left therein.

5           In the third embodiment, in addition to the second embodiment, after a warning of communication charge, if a user instructs to continue transmission/reception data, the warning money amount is increased automatically, and transmission/reception the set of objective  
10 data to be transmitted/received is continued. Thereby, even when the data amount and importance degree of the set of objective data to be transmitted/received is not clear, data is transmitted/received continuously anyway, and when the data transmitted/received amount  
15 increases further, user may judge whether to continue or terminate communication, therefore, it is possible to conduct further effective data communications.

          The present invention has been explained in reference to the preferred embodiments, however, it  
20 is well known that the present invention is not limited to the embodiments described above, and various modifications and applications are possible without departing from the spirit thereof.

          For example, the preferred embodiment has been  
25 explained with the data amount in the data amount accounting method as packet, while calculation may be made by bytes according to an account unit. In this

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case, the charge information per packet 22A, the  
transmitted packet counter 22I, and the received packet  
counter 22J may be set as charge per byte information,  
transmitted byte counter, and received byte counter,  
5 as shown in parentheses in FIG. 1B, and the packet in  
each flowchart may be read as byte. The communication  
processing flow of the third embodiment may be employed  
in an actual communication processing to be conducted  
in the communication connection request processing  
10 flow of the first embodiment, and the communication  
processing flow of the first embodiment may be employed  
in an actual communication processing to be conducted  
in the communication connection request processing flow  
of the second embodiment. In the second embodiment,  
15 consideration has been made with a processing in the  
case where the tag information showing sub data is  
contained in the data to be transmitted/received and to  
be recognized on the basis of the input information,  
while in the case when it is known in advance that  
20 there is no sub data, the processings in the step S58  
and the step S59 may be skipped, and the process may  
be set to return directly to the step S43. Further,  
instead of ending communication connection immediately  
after stopping transmission/reception data in the step  
25 S57, the process may be set to go back to the step S43  
and wait for instruction to transmit/receive next data.  
In the present embodiments, a warning is set to be made

when a specified warning money amount is exceeded,  
while a warning may be set as to made when the amount  
of transmitted/received data per unit time exceeds  
a certain amount.

5           Additional advantages and modifications will  
readily occur to those skilled in the art. Therefore,  
the invention in its broader aspects is not limited to  
the specific details and representative embodiments  
shown and described herein. Accordingly, various  
10       modifications may be made without departing from the  
spirit or scope of the general inventive concept as  
defined by the appended claims and their equivalents.

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